

REPORT DOCUMENTATION PAGE

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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

24 July 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2001-168**
C.T. Liu and J. Gonzalez (Clinical Micro Sensors), "Hybrid Experimental-Numerical J-Integral Analysis
and Crack Growth Resistance of a Particulate Composite Material (Keynote Lecture)"

International Conf. on Computational Science and Engineering
(Puerto Vallarta, Mexico, 20-24 August 2001) (Deadline: 14 Aug 2001)

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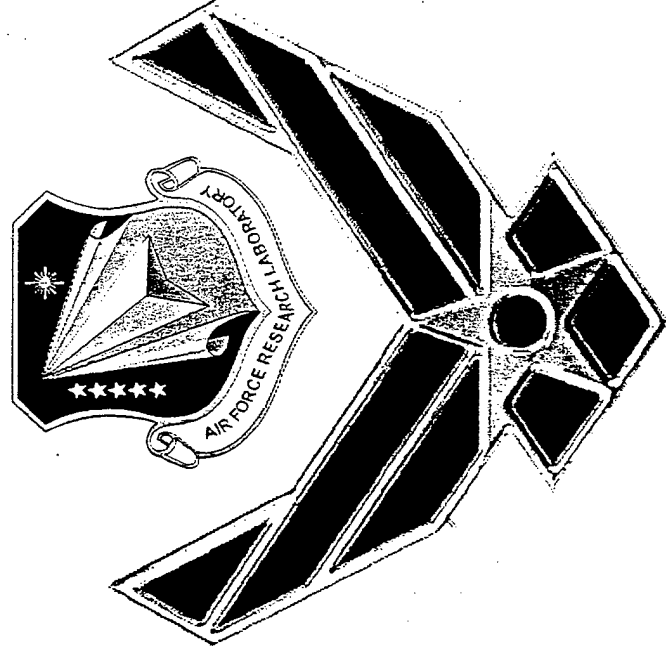
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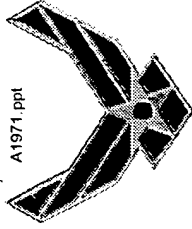
PHILIP A. KESSEL Date
Technical Advisor
Space and Missile Propulsion Division

HYBRID EXPERIMENTAL- NUMERICAL J-INTEGRAL ANALYSIS AND CRACK GROWTH RESISTANCE OF A PARTICULATE COMPOSITE MATERIAL



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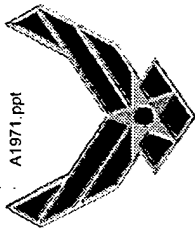
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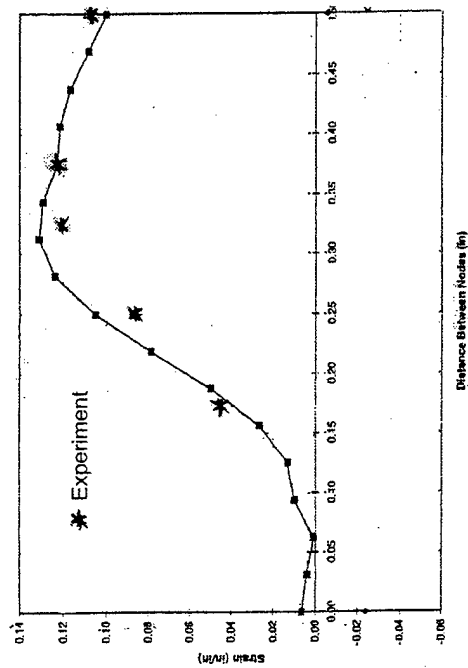
Objectives



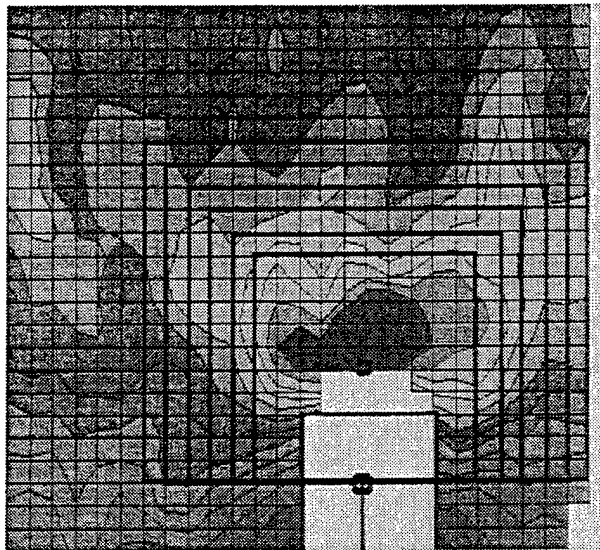
- Investigate the Inhomogeneous Nature of the Microstructure.
- Determine J-Integral Using a Hybrid Experimental-Numerical Technique.
- Investigate Crack Growth Behavior.



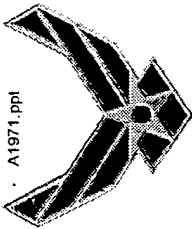
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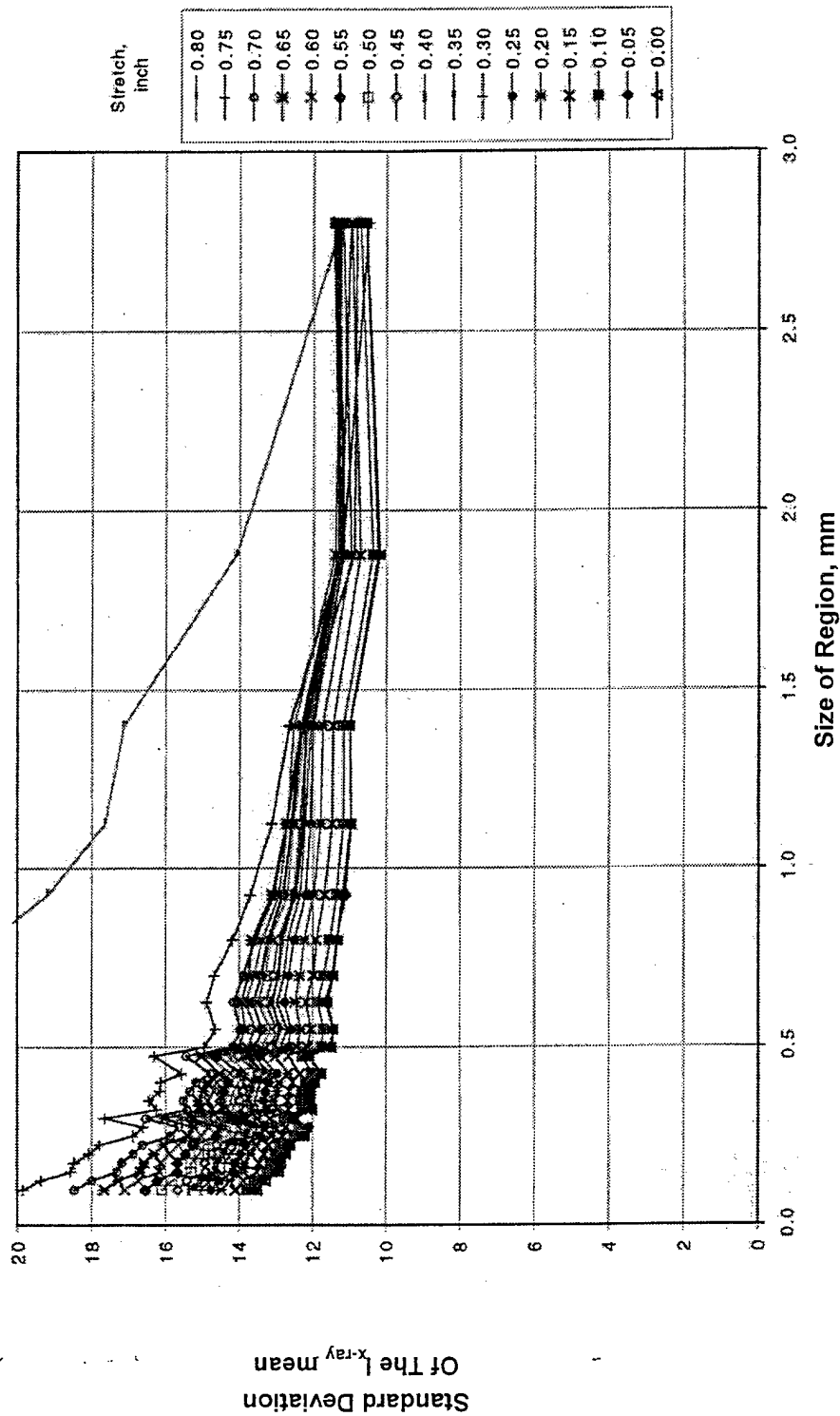
Normal Strain Along an Integration Path

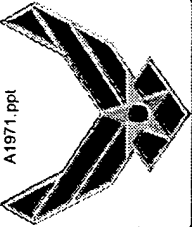


Strain Distributions and Integration Paths



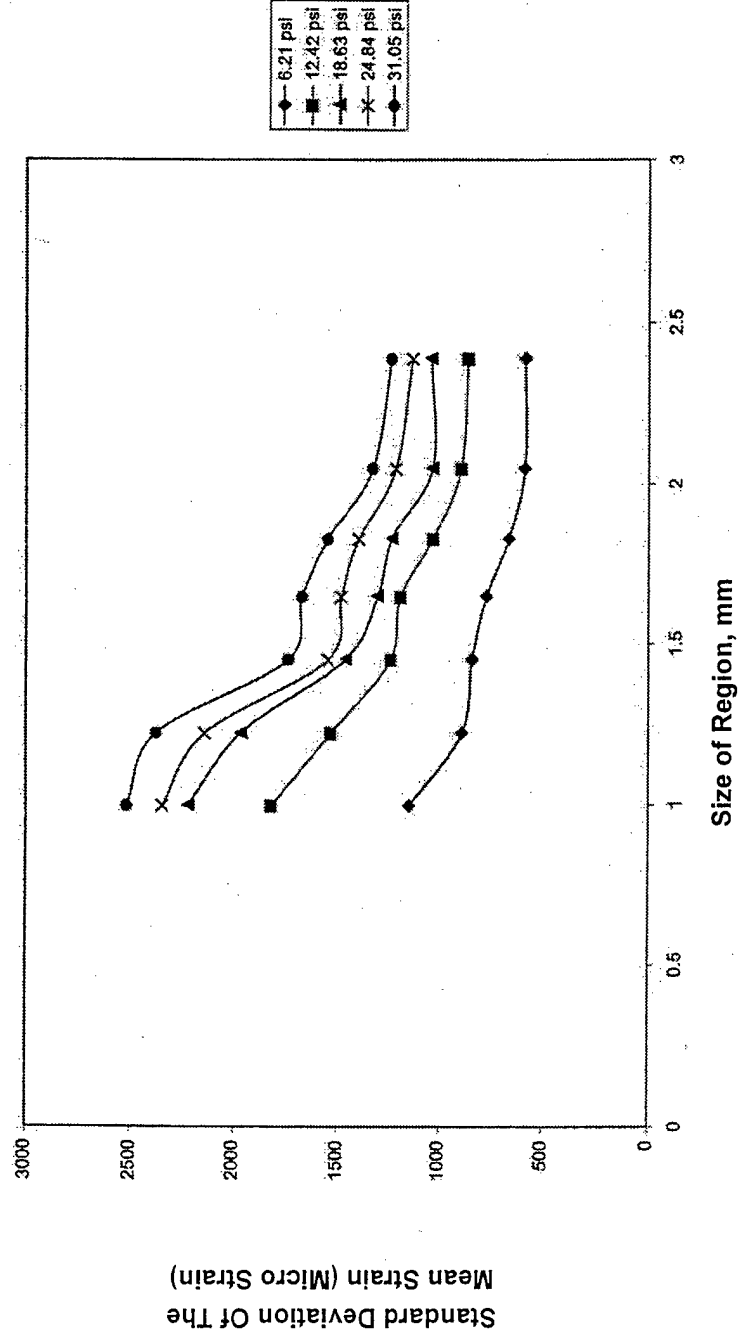
Standard Deviation of X-Ray Intensity Versus Size of Region as a Function of Applied Deformation



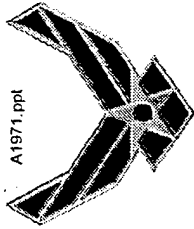


Standard Deviation of Strain Versus Size of Region as a Function of Applied Stress

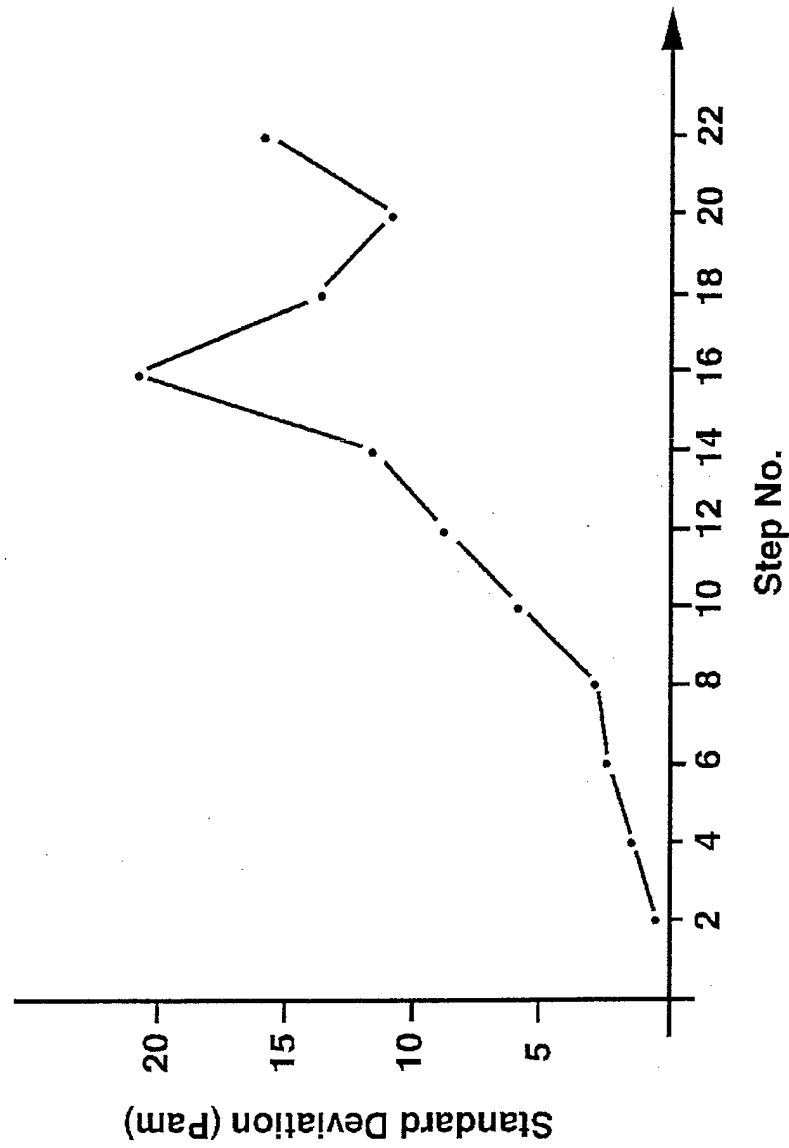
STD vs. Size of Region

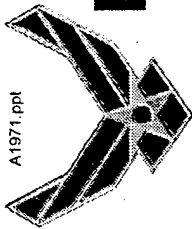




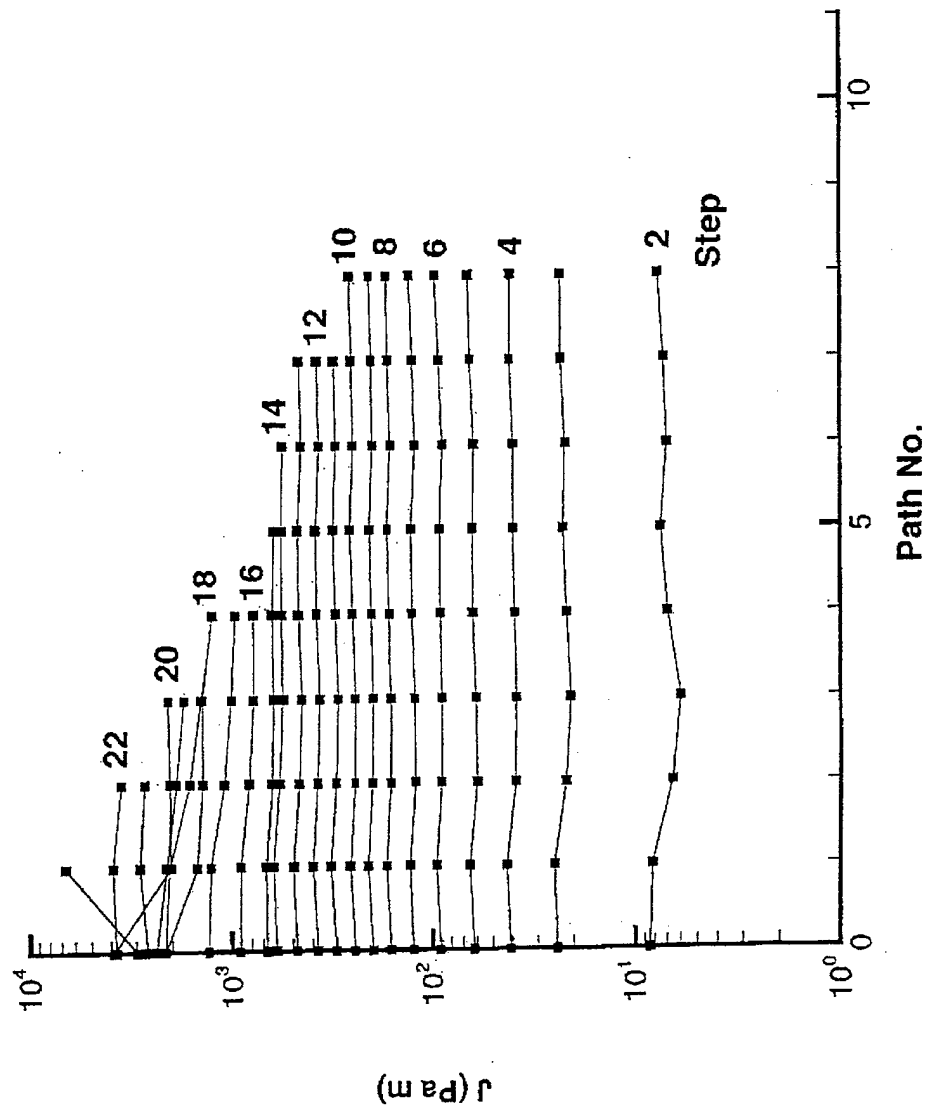


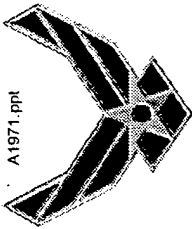
Standard Deviation of J-Integral Versus Step Number (Applied Strain)



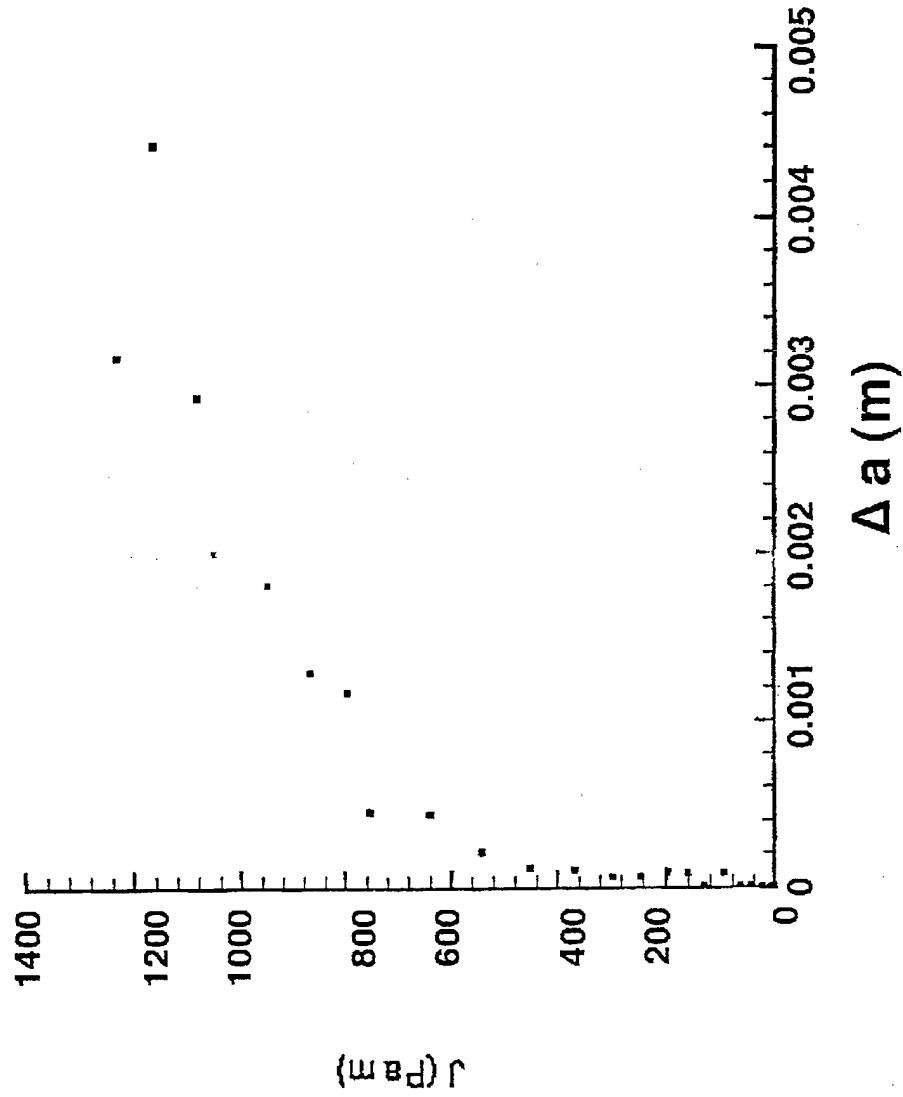


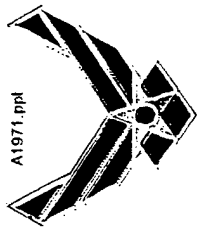
J-Integral Versus Path Number as a Function of Step Number (Applied Strain)



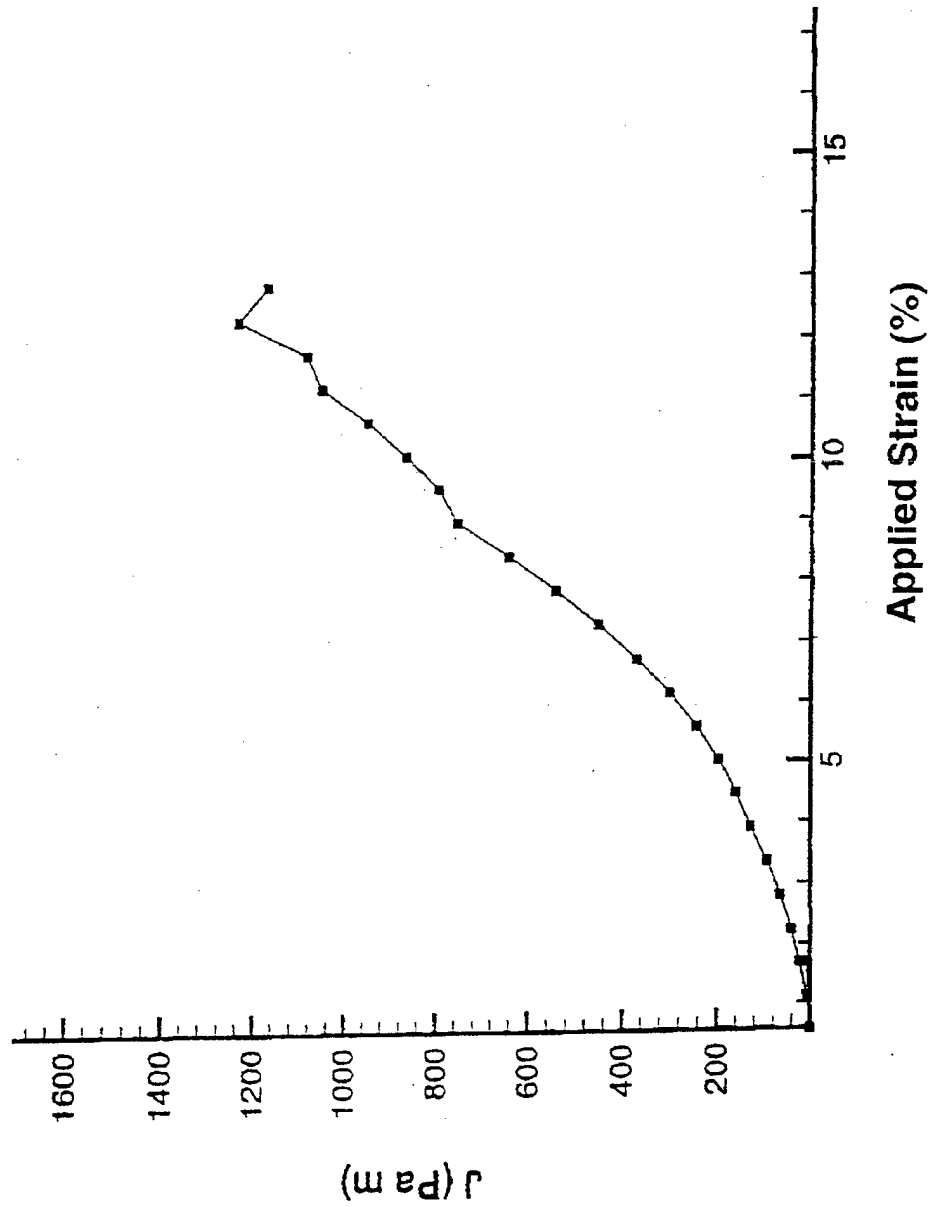


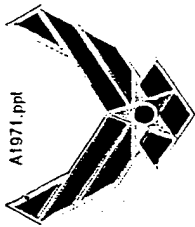
Crack Growth Resistance Curve



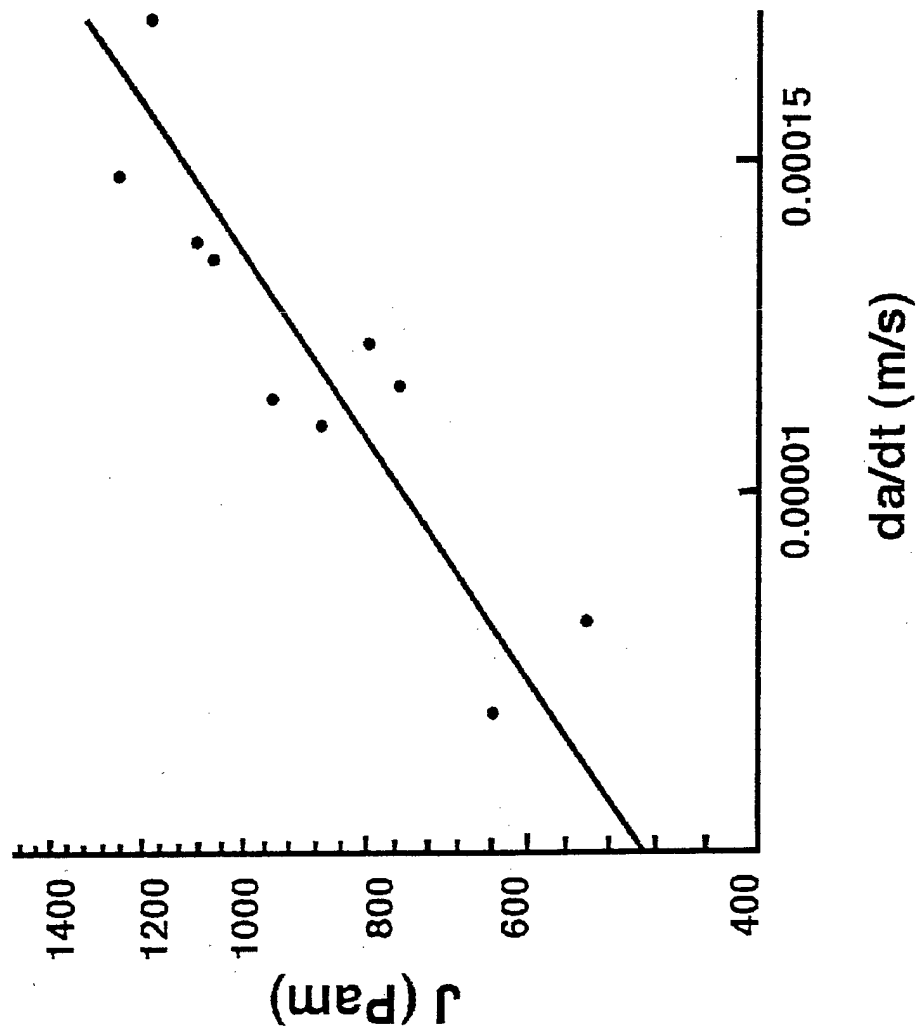


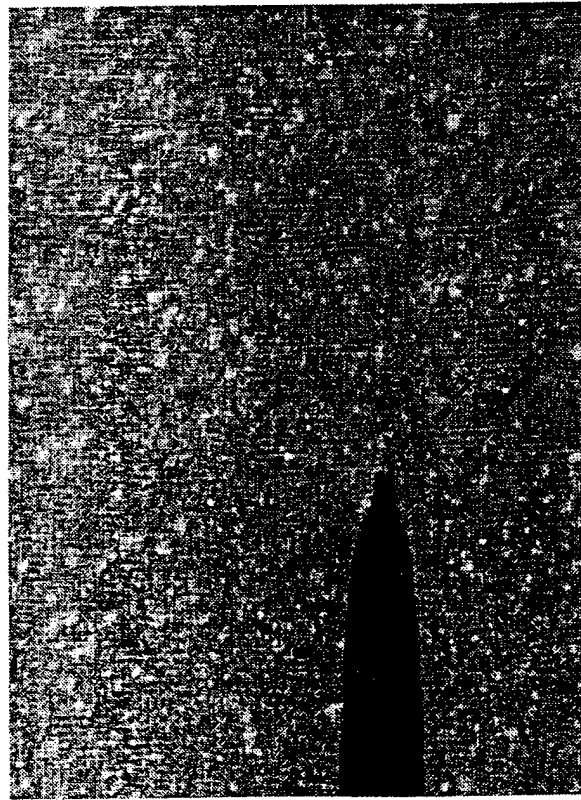
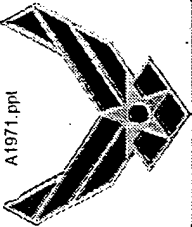
J-Integral Versus Applied Strain



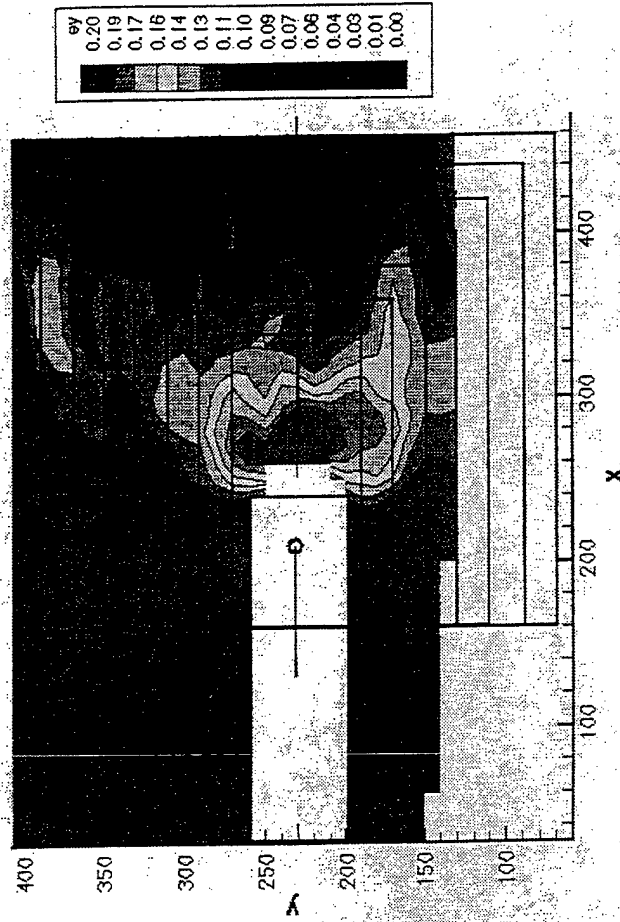


Crack Growth Rate Versus J-Integral

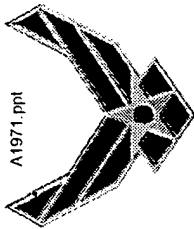




Deformed Image



Strain Distributions and
Integration Paths



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Conclusions



- The minimum area for a valid homogeneous continuum assumption of the particulate composite material is 2 mm x 2 mm.
- On the macroscopic scale, the J-Integral is independent of the integration path.
- A power law relationship exists between the J-Integral and the crack growth rate.